



# Antibiotic Resistance Increases with Local Temperature

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measures to minimize the economic impact of these infections and improve clinical outcomes in hospitalized patients.

Table 1. LOS and Hospital Cost

	Mean (SD)	Median	P-value
Hospital LOS (days)			
MDR PA	21 (19)	14	<0.0001
Non-MDR PA	17 (16)	12	
CR PA	22 (20)	14	
Non-CR PA	17 (16)	12	<0.0001
Hospital Costs (US \$)			
MDR PA	91,178 (106,913)	51,845	0.0007
Non-MDR PA	69,116 (74,389)	39,973	
CR PA	85,819 (101,457)	49,135	
Non-CR PA	61,434 (62,717)	39,632	0.0007

**Disclosures.** D. Zhang, Merck; Employee, Salary. J. Hawkshead III, Merck; Employee, Salary. S. Merchant, 1Merck & Co., Inc.; Employee and Shareholder, Salary

**469. Use of the Extensively Drug-resistant Organism (XDRO) Registry for Carbapenem-Resistant Enterobacteriaceae (CRE) Reporting and Initiation of Transmission Precautions — Chicago, Illinois, 2016**

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**Session:** 57. HAI: Surveillance + Reporting

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**Background.** Carbapenem-resistant Enterobacteriaceae (CRE) are a group of multidrug-resistant bacteria that cause ~9,000 infections annually; ~50% of CRE bloodstream infections are fatal. The use of contact precautions (CP) for CRE patients can prevent transmission. To improve CRE surveillance and interfacility communication about positive patients, Illinois implemented the extensively drug-resistant organism (XDRO) registry in 2013. Healthcare facilities must report a patient's first positive CRE culture per stay ≤7 days from culture confirmation. Facilities can query the registry at patient admission to identify CRE status and implement transmission precautions. We assessed facility timeliness of reporting and querying frequency and registry usefulness in identifying patients who should be on CP.

**Methods.** We analyzed Chicago XDRO data for November 2013–October 2016. Variables were facility type (hospital, long-term acute care hospital [LTACH], and skilled nursing facility [SNF]), culture date, and report date. Timeliness was time from culture collection to reporting. Nine facilities (2 hospitals, 4 LTACHs and 3 SNFs) completed a survey on querying frequency; all but 1 LTACH provided single day census and contact precaution lists. We compared these with the XDRO registry to identify CRE patients for whom querying would have initiated CP use.

**Results.** Chicago facilities reported 2,469 CRE cases. Median timeliness varied by facility type (hospitals: 8 days; SNF: 10 days; and LTACH: 55 days). Of patients on CP for CRE but not reported to the registry, 11/12 (92%) were in LTACHs. Reported querying frequency was daily for 1 hospital and rarely for other facilities. Overall, 91 patients at 8 facilities were in the registry; of these, 0/1 (0%) hospital, 3/27 (11%) LTACH, and 28/63 (44%) SNF patients were not on CP.

**Conclusion.** Timeliness of reporting CRE patients to the XDRO registry varied by facility type and exceeded the 7-day timeframe. Routine registry querying can identify CRE patients who should be on CP. Querying was uncommon in surveyed facilities, identifying an opportunity to improve transmission precautions among CRE patients, particularly in SNFs. We recommend facilities report cases in a timely manner and query the registry at patient admission.

**Disclosures.** M. Y. Lin, CareFusion Foundation: Grant Investigator, Research grant

**470. Antibiotic Resistance Increases with Local Temperature**

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**Background.** Antibiotic resistance is considered as one of our greatest emerging public health threats. Current understanding of the factors governing spread of antibiotic-resistant organisms and mechanisms among populations is limited.

**Methods.** We explored the roles of local temperature, population density, and additional factors on the distribution of antibiotic resistance across the United States, using a database of regional antibiotic resistance that incorporates over 1.6 million bacterial pathogens from human clinical isolates over the years 2013–2015.

**Results.** We identified that increasing local temperature as well as population density were associated with increasing antibiotic resistance in common pathogens. An

increase in temperature of 10°C was associated with increases in antibiotic resistance of 4.2%, 2.2%, and 3.6% for the common pathogens *Escherichia coli*, *Klebsiella pneumoniae*, and *Staphylococcus aureus*. The effect of temperature on antibiotic resistance was robust across almost all classes of antibiotics and pathogens and strengthened over time.

**Conclusion.** These findings suggest that current forecasts of the burden of antibiotic resistance could be significant underestimates in the face of a growing population and warming planet.

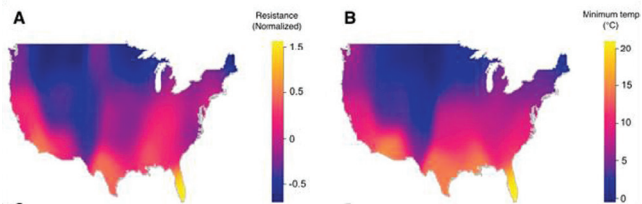


Figure 1. Antibiotic resistance increases with increasing temperature. (A) A heatmap of mean normalized antibiotic resistance for *E. coli* for all antibiotics across the USA. (B) A heatmap of 30-year average minimum temperature (°C) across the USA.

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**471. Molecular Characterization of Carbapenem-Resistant Enterobacteriaceae in the USA, 2011–2015**

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**Background.** Carbapenem-resistant Enterobacteriaceae (CRE) have emerged as an important cause of healthcare-associated infections. We characterized the molecular epidemiology of CRE in isolates collected through the Emerging Infections Program (EIP) at the Centers for Disease Control and Prevention (CDC).

**Methods.** From 2011–2015, 8 U.S. EIP sites (CO, GA, MD, MN, NY, NM, TN and OR) collected CRE (*Escherichia coli*, *Enterobacter aerogenes*, *Enterobacter cloacae* complex, *Klebsiella pneumoniae*, and *Klebsiella oxytoca*) isolated from a normally sterile site or urine. Isolates were sent to CDC for reference antimicrobial susceptibility testing and real-time PCR detection of carbapenemase genes (*bla*<sub>KPC-2</sub>, *bla*<sub>NDM-1</sub>, *bla*<sub>OXA-48</sub>). Phenotypically confirmed CRE were analyzed by whole genome sequencing (WGS) using an Illumina MiSeq benchtop sequencer.

**Results.** Among 639 Enterobacteriaceae evaluated, 414 (65%) were phenotypically confirmed as CRE using CDC's current surveillance definition (resistant to ertapenem, imipenem, doripenem, or meropenem). Among isolates confirmed as CRE, 303 (73%) were carbapenemase-producers (CP-CRE). The majority of CP-CRE originated from GA (39%), MD (35%) and MN (11%); most non-CP-CREs originated from MN (27%), CO (25%) and OR (17%). *K. pneumoniae* was the predominant carbapenemase-producing species (78%) followed by *E. cloacae* complex spp (12%), *E. coli* (7.9%), *E. aerogenes* (0.9%) and *K. oxytoca* (0.6%). The most common carbapenemase genes detected were *bla*<sub>KPC-3</sub> (76%) and *bla*<sub>KPC-2</sub> (19%); *bla*<sub>NDM-1</sub> and *bla*<sub>OXA-48</sub>-like genes were detected in 1.6% and 0.3% of isolates, respectively. For carbapenemase-producing *K. pneumoniae*, *Enterobacter* spp, and *E. coli*, the predominant sequence types (ST) were ST258 (65%), ST171 (35%) and ST131 (29%), respectively.

**Conclusion.** The distribution of CP and non-CP-CRE varied across the catchment sites. Among CP-CRE, KPC-producing *K. pneumoniae* predominated; other carbapenemases were rarely identified in the locations under surveillance. Strain types known to have increased epidemic potential (ST258 and ST131) were common among carbapenemase-producing *K. pneumoniae* and *E. coli* isolates, respectively.

**Disclosures.** All authors: No reported disclosures.

**472. Instituting Public Health Laboratory Surveillance for Methicillin-resistant Staphylococcus aureus (MRSA), Extended-Spectrum B Lactamase producing Enterobacteriaceae (ESBL), and Carbapenem-resistant Enterobacteriaceae (CRE) in a Large Metropolitan County**